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ENVIRONMENT CANADA
CONSERVATION AND PROTECTION
ENVIRONMENTAL PROTECTION
PACIFIC AND YUKON REGION

BENTHIC SEDIMENT CHEMISTRY
WEST COAST SURVEY
PHASE II
JUNE 1988
REGIONAL DATA REPORT DR-90-05

BY

D.E. Brothers

JUNE 1990

TABLE OF CONTENTS

		Page
TABLES OF CONTENTS		i
	List of Figures	ii
	List of Tables	ii
1.0	INTRODUCTION	1
2.0	MATERIAL AND METHODS	3
APPENDIX I	ACCURACY DATA	17
APPENDIX II	RAW DATA: E.P. WEST COAST SURVEY PHASE II - JUNE 1988	19

LIST OF FIGURES

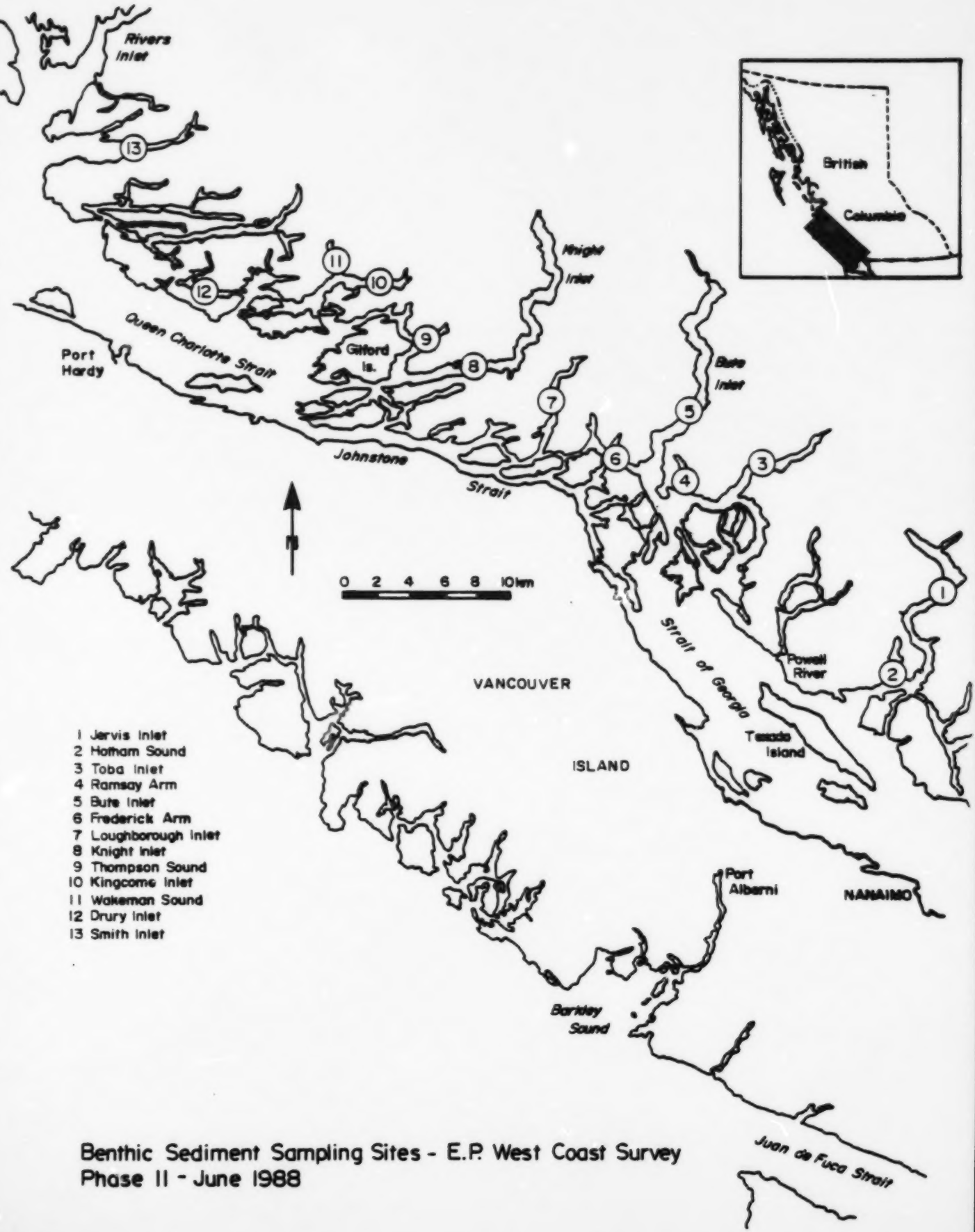
Figure		Page
1	Benthic Sediment Sampling Sites - E.P. West Coast Survey Phase II - June 1988	2

LIST OF TABLES

Table		Page
1	Jervis Inlet - Station 1	4
2	Hotham Sound - Station 2	5
3	Toba Inlet - Station 3	6
4	Ramsay Arm - Station 4	7
5	Bute Inlet - Station 5	8
6	Frederick Arm - Station 6	9
7	Loughborough Inlet - Station 7	10
8	Knight Inlet - Station 8	11
9	Thompson Sound - Station 9	12
10	Kingcome Inlet - Station 10	13
11	Wakeman Sound - Station 11	14
12	Drury Inlet - Station 12	15
13	Smith Inlet - Station 13	16

1.0 INTRODUCTION

In June 1988 phase II of a benthic sediment chemistry study was conducted on the west coast of British Columbia between Jervis Inlet and Cape Caution using the survey vessel CSS Vector (Figure 1). The study was initiated at the request of the Regional Ocean Dumping Advisory Committee (RODAC) and was designed to examine the "background" concentrations of various metals in inlets and water ways removed from anthropogenic inputs. This survey is a continuation of EP West Coast Survey Phase I, June 1987. (Regional Data Report Dr-90-04)



Benthic Sediment Sampling Sites - E.P. West Coast Survey
Phase II - June 1988

2.0 MATERIAL & METHODS

Grab samples were taken using a Smith McIntyre sampler; core samples using a 2 metre Benthos gravity corer.

Three grabs were taken at each station. Upon retrieval, water was siphoned from the sediment surface, if necessary. Three samples, 0 cm to 5 cm sediment depth, were taken from the first grab; two samples, one 0 cm to 5 cm, the other 0 cm to 2 cm, were taken from the second grab; and one sample, 0 cm to 5 cm, was taken from the third.

One core was also taken at each station. The core was extruded into a plastic trough, held at a gentle incline and washed to remove the outer disturbed layer, and sampled at the following depths: 30-40 cm, 60-70 cm and 90-100 cm.

Cadmium, mercury, lead, copper and zinc concentrations are presented in the tables, along with the mean and standard deviation.

All analyses were conducted by Conservation and Protection Laboratories in West Vancouver. The raw data represents a single analysis for each sample after drying and homogenizing. Cu, Pb, and analysed using Inductively Coupled Argon Plasma Atomic Emission (ICAP-AE), Cd using Graphite Furnace Atomic Absorption (GFAA), and Hg using flameless AA.

The accuracy data for each lab submission are given in Appendix I. The raw data printouts, giving the complete ICAP semi-quantitative scan and particle size data, are included in Appendix II, and can be located by matching the sample and lab submission numbers given on the data tables. Precision data for the lab submissions are provided on the data tables, and represent analyses of separate aliquots of dryed, homogenized sediments from the sample bag.

TABLE 1

JERVIS INLET - STATION 1

METALS LAB # 880905
PARTICLE SIZE LAB # 880905

DATE SAMPLED: JUNE 20, 1988.

STN	DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
	376	1*	0-5	.094	.36	10	62.6	151.0
	376	2	0-5	.073	.43	10	63.6	155.0
	376	3	0-5	.074	.49	20	61.9	165.0
	374	4	0-5	.076	.44	10	65.8	156.0
	374	5*	0-2	.078	.39	10	64.7	176.0
	367	6	0-5	.075	.39	10	63.0	162.0
			MEAN	.078	.42	12	63.6	160.8
			STD DEV	.008	.05	4	1.4	9.0
	367	7*	30-40	.037	.72	ND(8)	58.3	112.0
		8*	60-70	.039	.85	ND(8)	58.0	117.0
		9*	90-100	.036	.60	ND(8)	55.9	115.0

NOTE: numbers in brackets are limits of detection
ND - not detected
* denotes particle size data in appendix

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
10	.170	.93	31	101.0	250.0
105	.183	1.20	30	97.5	241.0
125	.173	1.20	10	97.2	239.0
126	.160	1.40	18	95.1	237.0
127	.160	1.40	20	93.7	239.0
MEAN	.169	1.23	22	96.9	241.2
STD DEV	0.10	.19	9	2.8	5.1
20	.063	.30	ND (8)	114.0	167.0
106	.060	.52	ND (8)	114.0	167.0
128	.046	.32	ND (8)	110.0	163.0
129	.046	.35	ND (8)	111.0	160.0
130	.042	.29	ND (8)	111.0	161.0
MEAN	.051	.36		112.0	163.6
STD DEV	.009	.09		1.9	3.3

NOTE: numbers in brackets are limits of detection

(cf: SCPJV1-1)

TABLE 2

HOTHAM SOUND - STATION 2

METALS LAB # 880905
PARTICLE SIZE LAB # 880905

DATE SAMPLED: JUNE 20, 1988.

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)		UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
508	10*	0-5		.170	.93	31.0	101.0	250.0
508	11	0-5		.160	1.00	26.0	98.0	225.0
508	12	0-5		.181	1.00	28.0	98.1	257.0
508	13	0-5		.186	.96	28.0	96.0	225.0
508	14*	0-2		.174	.80	27.0	92.0	224.0
510	15	0-5		.175	.86	30.0	92.5	226.0
			MEAN	.174	.93	28.3	96.3	234.5
			STD DEV	.009	.08	1.9	3.5	14.9
500	16*	30-40		.100	1.74	10.0	75.7	145.0
	17*	60-70		.088	1.50	9.0	74.9	142.0
	18*	90-100		.081	1.68	10.0	76.1	133.0

NOTE: numbers in brackets are limits of detection
ND - not detected
* denotes particle size data in appendix

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
10	.170	.93	31	101.0	250.0
105	.183	1.20	30	97.5	241.0
125	.173	1.20	10	97.2	239.0
126	.160	1.40	18	95.1	237.0
127	.160	1.40	20	93.7	239.0
MEAN	.169	1.23	22	96.9	241.2
STD DEV	0.10	.19	9	2.8	5.1
20	.063	.30	ND (8	114.0	167.0
106	.060	.52	ND (8	114.0	167.0
128	.046	.32	ND (8	110.0	163.0
129	.046	.35	ND (8	111.0	160.0
130	.042	.29	ND (8	111.0	161.0
MEAN	.051	.36		112.0	163.6
STD DEV	.009	.09		1.9	3.3

NOTE: Numbers in brackets are limits of detection

(cf: SCPHDD-2)

TABLE 3

TOBA INLET (STATION 3)

METALS LAB # 880905
DATE SAMPLED: JUNE 20, 1988 PARTICLE SIZE LAB # 880905

UG/G DRY WEIGHT

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	Hg	Cd	Pb	Cu	Zn
497	19*	0-5	.065	.25	ND(8)	112.0	167.0
497	20	0-5	.063	.30	ND(8)	114.0	167.0
497	21	0-5	.059	.23	ND(8)	112.0	158.0
492	22	0-5	.058	.26	8	115.0	174.0
492	23*	0-2	.055	.20	ND(8)	117.0	187.0
491	24	0-5	.062	.22	10	113.0	169.0
		MEAN	.061	.24		113.8	170.3
		STD DEV	.004	.04		1.9	9.7

NOTE: numbers in brackets are limits of detection
ND - not detected
* denotes particle size data in appendix

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
10	.170	.93	31	101.0	250.0
105	.183	1.20	30	97.5	241.0
125	.173	1.20	10	97.2	239.0
126	.160	1.40	18	95.1	237.0
127	.160	1.40	20	93.7	239.0
MEAN	.169	1.23	22	96.9	241.2
STD DEV	0.10	.19	9	2.8	5.1
20	.063	.30	ND (8)	114.0	167.0
106	.060	.52	ND (8)	114.0	167.0
128	.046	.32	ND (8)	110.0	163.0
129	.046	.35	ND (8)	111.0	160.0
130	.042	.29	ND (8)	111.0	161.0
MEAN	.051	.36		112.0	163.6
STD DEV	.009	.09		1.9	3.3

NOTE: numbers in brackets are limits of detection. (cf: SCPHCH-3)
ND - not detected

TABLE 4

RAMSAY ARM - STATION 4

METALS LAB #880905
DATE SAMPLED: JUNE 21, 1988. PARTICLE SIZE LAB #880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
432	25*	0-5	.089	.62	17	75.7	135.0
432	26	0-5	.093	.50	10	73.6	135.0
432	27	0-5	.097	.48	18	71.5	140.0
431	28	0-5	.091	.60	19	74.3	139.0
431	29*	0-2	.094	.59	18	72.2	142.0
433	30	0-5	.093	.46	22	74.4	143.0
		MEAN	.093	.54	17	73.6	139.0
		STD DEV	.003	.07	4	1.5	3.4
420	31*	30-40	.052	.67	10	59.1	101.0
	32*	60-70	.038	.84	ND(8)	61.0	97.1
	33*	90-100	.039	.70	ND(8)	59.6	91.2

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
30	.093	.46	22	74.4	143.0
107	.095	.67	10	77.2	151.0
131	.077	.45	ND(8)	74.1	145.0
132	.076	.48	ND(8)	72.1	136.0
133	.078	.50	ND(8)	73.4	147.0
MEAN	.084	.51		74.2	144.4
STD DEV	.009	.09		1.9	5.5

NOTE: numbers in brackets are limits of detection. (cf:SCPRAMA4).
ND - not detected
* denotes particle size data in appendix.

TABLE 5

BUTE INLET - STATION 5

METALS LAB #880905
DATE SAMPLED: JUNE 21, 1988. PARTICLE SIZE LAB #880905

DEPTH	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
669	34*	0-5	.026	.10	ND(8)	90.1	113.0
669	35	0-5	.029	.10	ND(8)	92.4	114.0
669	36	0-5	.026	.10	ND(8)	88.6	107.0
669	37	0-5	.029	.10	ND(8)	93.3	115.0
669	38*	0-2	.031	.10	ND(8)	100.0	141.0
667	39	0-5	.029	.10	ND(8)	93.6	122.0
		MEAN	.028	.10		93.0	118.7
		STD DEV	.002	0		3.9	11.9

NOTE: numbers in brackets are limits of detection. (cf:SCPBUTE5).
ND - not detected
* denotes particle size data in appendix.

TABLE 6

FREDERICK ARM - STATION 6

METALS LAB # 880905
DATE SAMPLED: JUNE 21, 1988. PARTICLE SIZE LAB# 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
350	40*	0-5	.023	.20	ND(8)	26.4	68.6
350	41	0-5	.024	.20	ND(8)	25.7	70.0
350	42	0-5	.028	.10	ND(8)	24.1	66.2
336	43	0-5	.036	.20	ND(8)	29.3	68.1
336	44*	0-2	.037	.19	ND(8)	28.8	65.2
341	45	0-5	.038	.10	ND(8)	27.5	66.5
		MEAN	.031	.17		27.0	67.4
		STD DEV	.007	.05		2.0	1.8

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
40	.023	.20	ND(8)	26.4	68.6
108	.023	.28	ND(8)	25.6	63.3
134	.023	.10	ND(8)	23.3	65.9
135	.023	.10	ND(8)	22.0	68.2
136	.020	.09	ND(8)	23.0	72.0
MEAN	.022	.15		24.1	67.6
STD DEV	.001	.08		1.9	3.2

NOTE: numbers in brackets are limits of detection. (cf:SCPFRED6)
ND - not detected
* denotes particle size data in appendix.

TABLE 7

LOUGHBOROUGH INLET - STATION 7

METALS LAB # 880905
DATE SAMPLED: JUNE 21, 1988. PARTICLE SIZE LAB # 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
263	46*	0-5	.150	.83	23	60.5	179.0
263	47	0-5	.120	.73	19	62.3	158.0
263	48	0-5	.130	.78	23	62.2	140.0
261	49	0-5	.120	.78	17	61.9	165.0
261	50*	0-2	.120	.81	24	58.6	163.0
259	51	0-5	.120	.72	20	61.7	148.0
		MEAN	.127	.78	21	61.2	158.8
		STD DEV	.012	.04	3	1.4	13.7
255	52*	30-40	.068	.73	ND(8)	56.7	93.5
	53*	60-70	.055	.89	ND(8)	52.9	87.8
	54*	90-100	.050	.91	ND(8)	53.7	89.3

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
50	.120	.81	24	58.6	163.0
109	.120	.85	17	61.7	168.0
137	.100	.62	10	60.2	177.0
138	.110	.65	10	59.7	172.0
139	.110	.57	10	59.6	#N/A!
MEAN	.112	.70	14	60.0	170
STD DEV	.008	.12	6	1.1	5.9

NOTE: numbers in brackets are limits of detection. (cf:SCPLOUB7)
ND - not detected
* denotes particle size data in appendix.

TABLE 8

KNIGHT INLET - STATION 8

DATE SAMPLED: JUNE 22,1988.

METALS LAB # 880905
PARTICLE SIZE LAB # 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
384	55*	0-5	.084	.33	20	75.5	164.0
384	56	0-5	.090	.32	10	75.8	152.0
348	57	0-5	.084	.29	10	78.1	157.0
386	58	0-5	.091	.34	16	77.2	154.0
386	59*	0-2	.089	.32	10	76.9	157.0
395	60	0-5	.064	.23	10	75.6	158.0
		MEAN	.084	.31	13	76.5	157.0
		STD DEV	.010	.04	4	1.0	4.1
376	61*	30-40	.051	.21	10	75.9	122.0
	62*	60-70	.035	.27	ND(8)	72.6	119.0
	63*	90-100	.032	.22	ND(8)	67.3	114.0

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
60	.064	.23	10	75.6	158.0
110	.081	.48	ND(8)	77.4	159.0
140	.074	.24	ND(8)	75.4	158.0
141	.070	.25	ND(8)	75.1	158.0
142	.070	.26	ND(8)	75.0	159.0
MEAN	.072	.29		75.7	158.4
STD DEV	.006	.11		1.0	.5

NOTE: numbers in brackets are limits of detection. (cf:SCPKNIG8)
ND - not detected
* denotes particle size data in appendix.

TABLE 9

THOMPSON SOUND - STATION 9

METALS LAB # 880905
DATE SAMPLED: JUNE 22, 1988. PARTICLE SIZE LAB # 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
217	64*	0-5	.084	.21	10	45.8	121.0
217	65	0-5	.087	.22	10	44.7	117.0
217	66	0-5	.088	.31	10	45.3	117.0
214	67	0-5	.083	.32	10	44.3	111.0
214	68*	0-2	.087	.28	18	45.1	117.0
202	69	0-5	.098	.25	20	44.8	120.0
		MEAN	.088	.27	13	45.0	117.2
		STD DEV	.005	.05	5	.5	3.5
	70*	30-40	.077	.29	8	43.5	89.6
	71*	60-70	.062	.25	9	39.8	77.5
	72*	90-100	.052	.31	ND(8)	39.0	74.7

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
70	.077	.29	8	43.5	89.6
111	.091	.62	8	48.2	100.0
143	.078	.36	ND(8)	42.8	92.4
144	.077	.36	ND(8)	40.9	91.1
145	.079	.38	ND(8)	41.9	97.8
MEAN	.080	.40		43.5	94.2
STD DEV	.006	.13		2.8	4.5

NOTE: numbers in brackets are limits of detection. (cf:SCPTHOM9)
ND - not detected
* denotes particle size data in appendix.

TABLE 10

KINGCOME INLET - STATION 10

METALS LAB # 880905
PARTICLE SIZE LAB # 880905

DATE SAMPLED: JUNE 22, 1988.

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
336	73*	0-5	.022	.06	ND(8)	52.5	119.0
336	74	0-5	.019	.06	ND(8)	52.7	119.0
334	75	0-5	.020	.03	ND(8)	53.6	116.0
334	76	0-5	.022	.09	ND(8)	54.9	117.0
334	77*	0-2	.021	.10	ND(8)	53.9	126.0
342	78	0-5	.029	.10	ND(8)	59.5	131.0
		MEAN	.022	.07		54.5	121.3
		STD DEV	.004	.03		2.6	5.9
	79*	30-40	.020	.10	ND(8)	66.6	116.0

NOTE: numbers in brackets are limits of detection. (cf:SCPKIN10)
ND - not deleted
* denotes particle size data in appendix.

TABLE 11

WAKEMAN SOUND - STATION 11

METALS LAB # 880905
DATE SAMPLED: JUNE 22, 1988. PARTICLE SIZE LAB # 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
417	80*	0-5	.010	.10	ND(8)	34.2	102.0
417	81	0-5	.010	.10	ND(8)	35.0	103.0
417	82	0-5	.010	.10	ND(8)	35.9	100.0
405	83	0-5	.008	.10	ND(8)	32.4	94.1
405	84*	0-2	.010	.10	ND(8)	33.3	94.1
422	85	0-5	.010	.10	ND(8)	37.0	108.0
		MEAN	.010	.10		34.6	100.2
		STD DEV	.001	0		1.7	5.4
	86*	30-37	ND(.008)	.10	ND(8)	34.4	96.5

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
80	.010	.10	ND(8)	34.2	102.0
112	.017	.29	ND(8)	33.7	107.0
146	.020	.10	ND(8)	31.5	110.0
147	.010	.10	ND(8)	30.8	99.8
148	.010	.10	ND(8)	28.4	105.0
MEAN	.013	.14		31.7	104.8
STD DEV	.005	.08		2.3	4.0

NOTE: numbers in brackets are limits of detection. (cf:SCPWAK11)
Nd - not detected
* denotes particle size data in appendix.

TABLE 12

DRURY INLET - STATION 12

METALS LAB # 880905
DATE SAMPLED: JUNE 22, 1988. PARTICLE SIZE LAB# 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
73	87*	0-5	.088	2.60	ND(8)	27.5	90.8
73	88	0-5	.100	3.40	ND(8)	28.1	95.4
73	89	0-5	.093	2.80	ND(8)	25.8	95.4
71	90	0-5	.110	5.23	ND(8)	28.4	91.8
71	91*	0-2	.120	4.90	ND(8)	30.1	92.4
66	92	0-5	.099	4.67	ND(8)	28.0	87.6
		MEAN	.102	3.93		28.0	92.2
		STD DEV	.012	1.14		1.4	3.0
	93*	30-40	.037	3.50	ND(8)	30.6	67.2
	94*	60-70	.041	6.14	ND(8)	61.7	77.9
	95*	90-100	.035	5.15	ND(8)	34.0	80.7

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
90	.110	5.23	ND(8)	28.4	91.8
113	.110	4.59	ND(8)	30.5	91.0
150	.100	4.65	ND(8)	27.1	98.0
151	.110	4.34	ND(8)	25.1	87.8
152	.110	3.99	ND(8)	25.0	86.9
MEAN	.108	4.56		27.2	91.1
STD DEV	.004	.46		2.3	4.4

NOTE: numbers in brackets are limits of detection. (cf:SCPDRU12)
ND - not detected
* denotes particle size data in appendix.

TABLE 13 -16-

SMITH INLET - STATION 13

METALS LAB # 880905
DATE SAMPLED: JUNE 23, 1988. PARTICLE SIZE LAB# 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT Hg	Cd	Pb	Cu	Zn
388	96*	0-5	.120	.92	ND(8)	37.2	145.0
388	97	0-5	.120	.98	ND(8)	38.5	125.0
388	98	0-5	.120	.89	ND(8)	38.9	136.0
384	99	0-5	.120	.96	9	38.4	114.0
384	100*	0-2	.120	.95	ND(8)	37.7	131.0
381	101	0-5	.120	.99	ND(8)	37.1	118.0
		MEAN	.120	.95		38.0	128.2
		STD DEV	0	.04		.7	11.5
	102*	30-40	.097	.89	ND(8)	36.3	114.0
	103*	60-70	.077	1	ND(8)	34.2	74.3
	104*	90-100	.062	1	ND(8)	33.0	70.9

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
100	.120	.95	ND(8)	37.7	131.0
114	.120	1.00	ND(8)	37.6	130.0
152	.110	.58	ND(8)	34.1	126.0
153	.120	.69	ND(8)	35.6	125.0
154	.120	.75	ND(8)	35.6	138.0
MEAN	.118	.79		36.1	130.0
STD DEV	.004	.18		1.5	5.1

NOTE: numbers in brackets are limits of detection. (cf:SCPSMI13)
ND - not detected
* denotes particle size data in appendix.

APPENDIX I

ACCURACY DATA

ACCURACY DATA

LAB #880905

	Hg	Cd	Pb	Cu	Zn
MESS-1					
CERTIFIED:	0.171 +/- 0.014	0.59 +/- 0.10	34.0 +/- 6.1	25.1 +/- 3.8	191 +/- 17
FOUND:	.220	.67	31	26.8	192.0
	.195	.60	30	30.0	185.0
	.188	.65	29	29.0	186.0
	.200	.64	28	28.0	187.0
	.198	.64	29	29.0	192.0
MEAN	.200	.64	29	28.6	188.4
STD DEV	.012	.03	1	1.2	3.4
BCSS-1					
CERTIFIED:	0.129 +/- .012	0.25 +/- .04	22.7 +/- 3.4	18.5 +/- 2.7	119 +/- 12
FOUND:	.150	.24	18	17.8	112.0
	.160	.26	19	17.4	112.0
	.150	.28	20	17.6	115.0
	.150	.27	20	18.0	113.0
	.150	.25	17	17.6	113.0
MEAN	.152	.26	19	17.7	113.0
STD DEV	.004	.02	1	.2	1.2

(cf:AC880905)

NOTE: numbers in brackets are limits of detection.
ND - not detected